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Corporation

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ENVIRONMENTAL
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Environmental Control Solutions

Laboratory Animal Facilities

History of HVAC in Vivariums

- Minor environmental instability can dramatically flaw research data
- Cost of lost research or animal stock is very high
 - *NY Times*, October, 2000: “A breeding pair of transgenic rodents sold for \$700,000”
- Numerous chronic HVAC problems
 - Lack of straight duct affects box flow performance
 - Dust and dander affect flow probe readings
 - Frequent recalibration and rebalancing of devices

Environmental Control Criteria

■ ILAR

- *The Guide for the Care & Use of Laboratory Animals*

■ ASHRAE

- American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (www.ashrae.org)

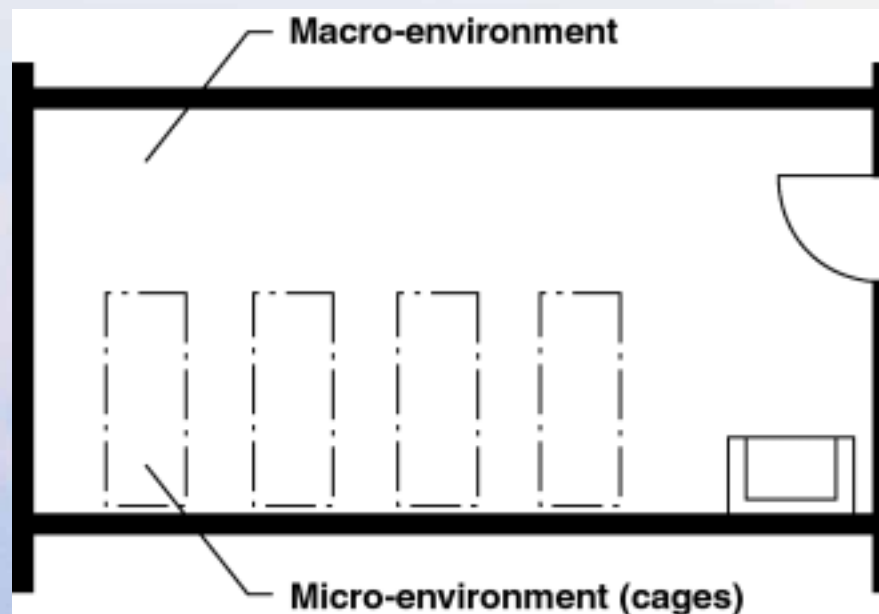
■ NIH

- Vivarium Design Policy & Guidelines

Environmental Control Criteria

Primary objective: STABLE environment for research

The Guide: "...minimize variations that can affect research results."



Secondary Objective:
Safety and comfort for animals & people

Macro- and Micro-environments

Macro-environment
(Room)

Micro-environment
(Cage)



Environmental Requirements

■ Temperature Control

- Room capability: 61 to 84° F
- Maintain $\pm 2^{\circ}\text{F}$ of set point

■ Relative Humidity

- 30 to 70% $\pm 10\%$
- Set point ~ 45 to 50%

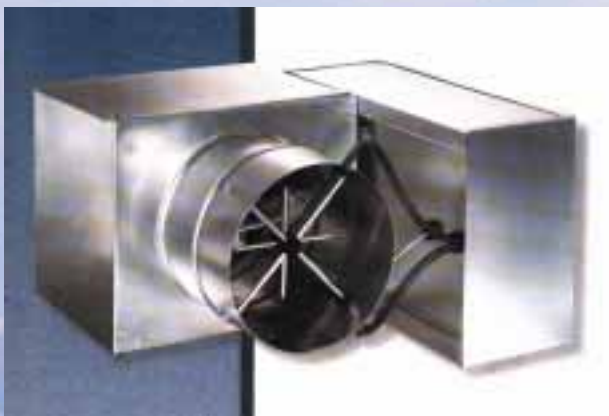
■ Air Change Rate

- 10 to 15 Air Changes per Hour (ACH)

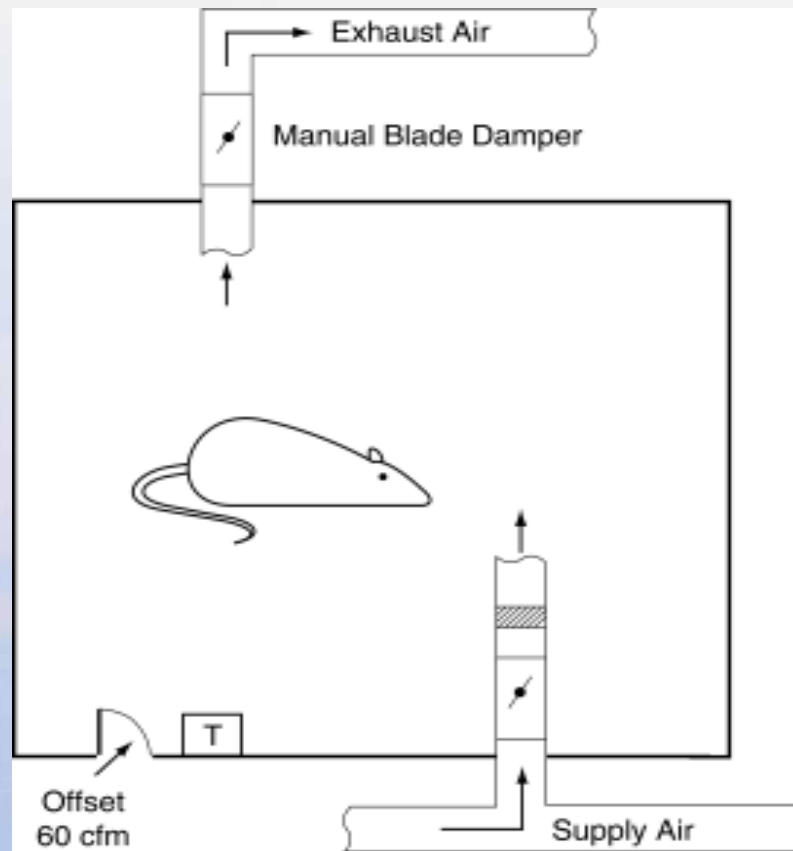




Airflow control devices will make or break the stability of the macro-environment.

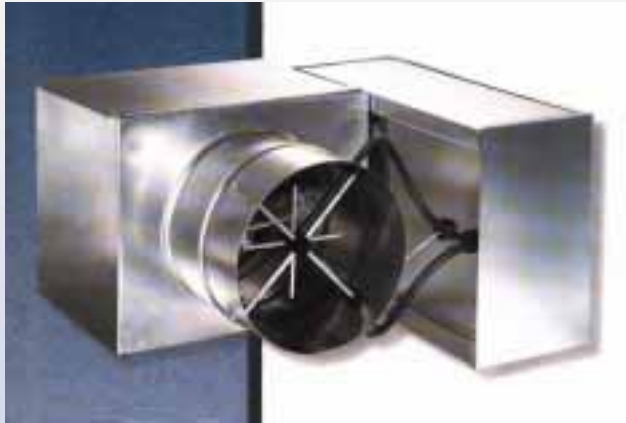


Manual Balancing Devices



Crude and ineffective balancing

Commercial-grade Airflow Controls



Dust and Dander: Very Common



Spaces are tight.

Automatic, Self-balancing Valve

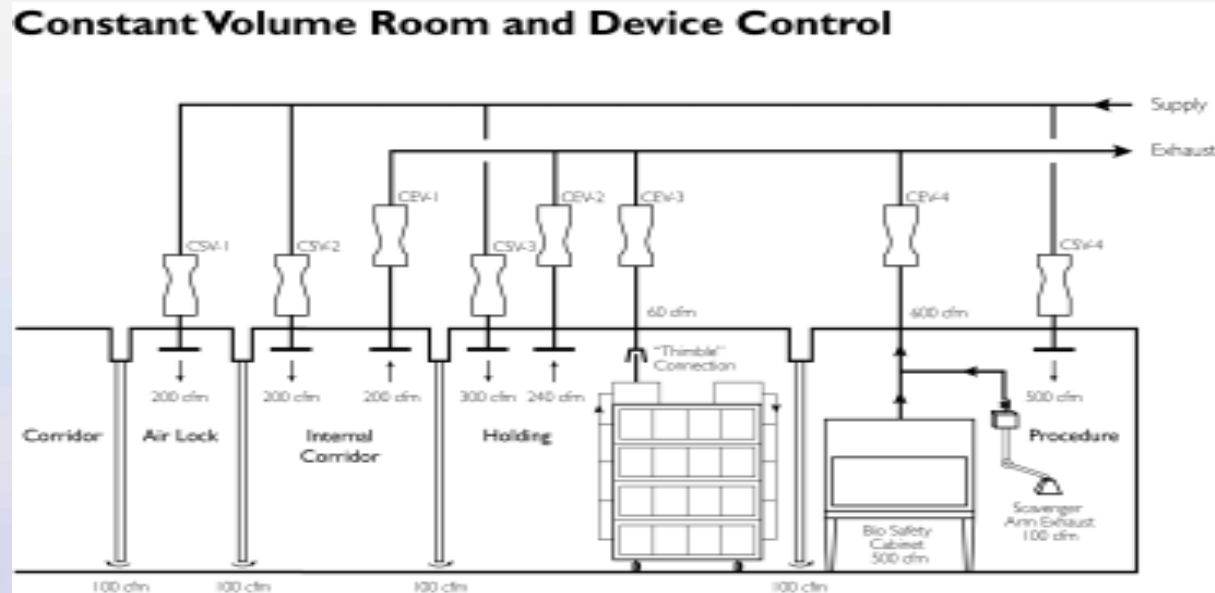


Airflow Control Strategies

- Constant volume
- Switchable pressurization
- Variable air volume



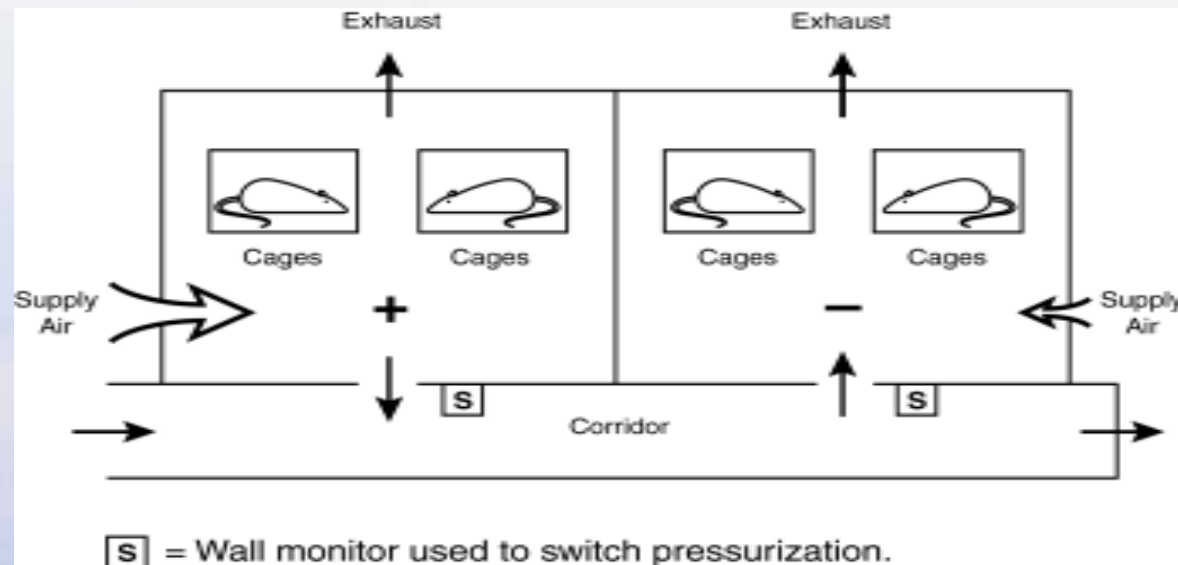
Constant Volume



■ Simple control

- No pneumatics or power requirement
- Low maintenance (unless manual dampers!)
- Inexpensive application
- May not offer the flexibility you need

Switchable Pressurization



- Simple and reliable reversible holding rooms
- Low maintenance
- Simple interface to BMS

Variable Air Volume (VAV)

- Switch to lower flow during unoccupied hours
 - (but still maintain animal's stable micro-environment)
- Outbreak in holding room (switch to negative pressure)
- During fumigation (low flow and negative pressure)
- Purge after fumigation

Macro- and Micro-environments

Macro-environment
(Room) →

Micro-environment
(Cage) →



Environmental requirements



Temperature Control

Room: 68 - 72°F

Cage EAT: 70 - 73°F

Pressurization

Room: + or -

Cage: almost always -

Relative Humidity

Room& cage: 40 - 55%

+/- 10% off set point

Air change rates

Room: 10 – 18 ACH,

Cage: 30 – 90 ACH

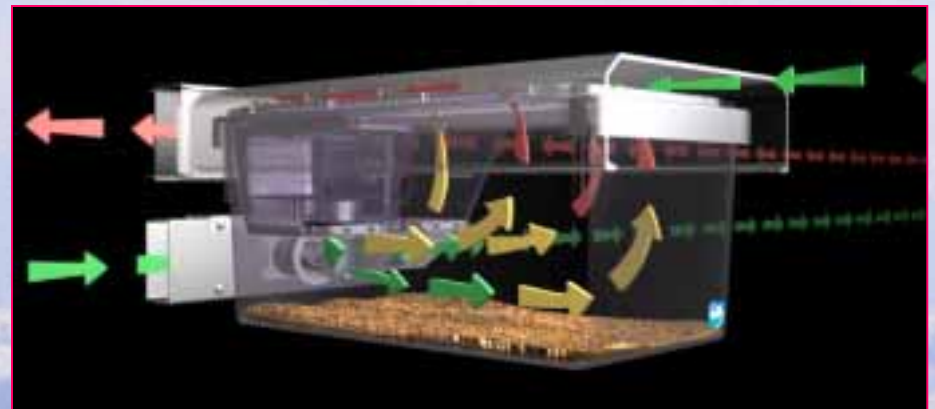


Cage Environments



Static, filter-top cage

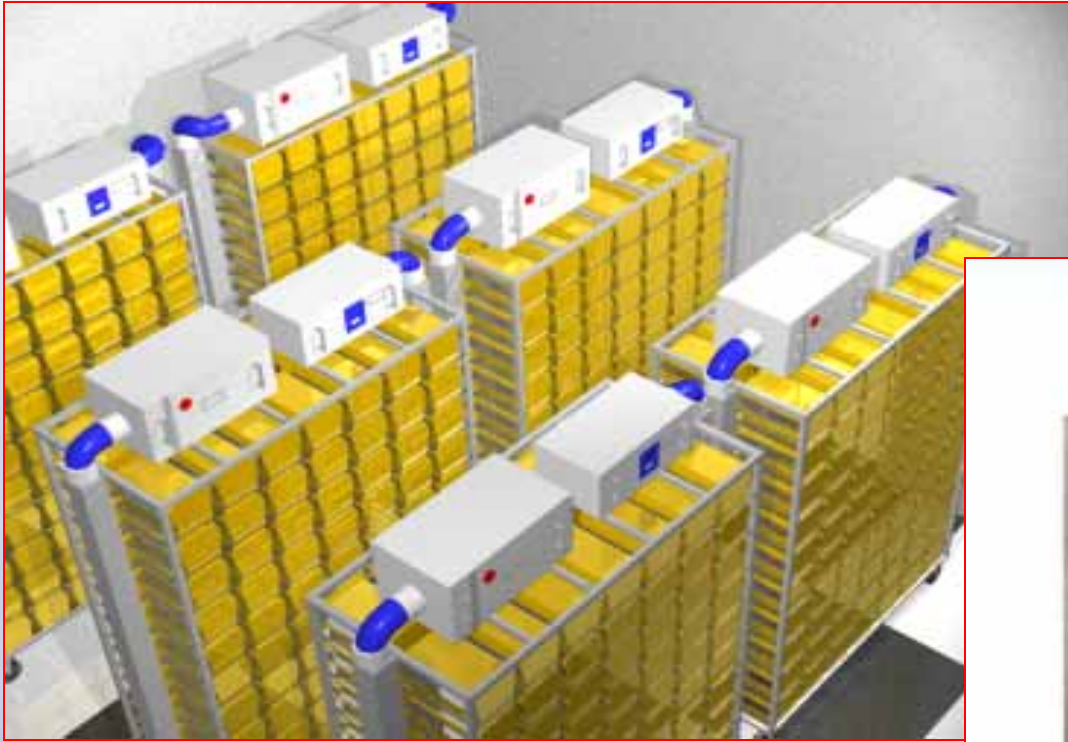
Ventilated



Critical Aspects of Cage Ventilation

- Stable environment for animal is critical
- Air velocity must be constant
- High air change rate: 30–90 ACH
- High ACH is not high flow!
 - Less than 1 CFM per cage
- Insufficient flow results in ammonia generation (keep cage RH <55%)

Traditional Racks with Fans



Supply and exhaust fans include HEPA filters.



Why connect racks to the building ventilation system?



Connection Options

- Thimbles
- Self-balancing valves only
- Self-balancing valves with load simulators

Manual Balancing Device Connection to Building Exhaust System



Dynamic situations change flows

Thimble Connections

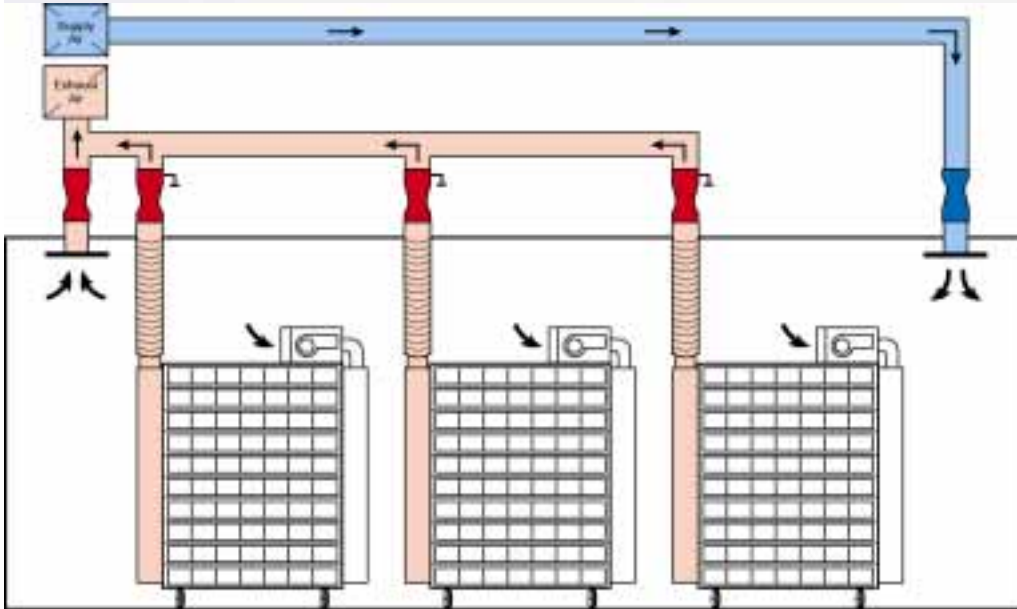


Decouples rack from building system

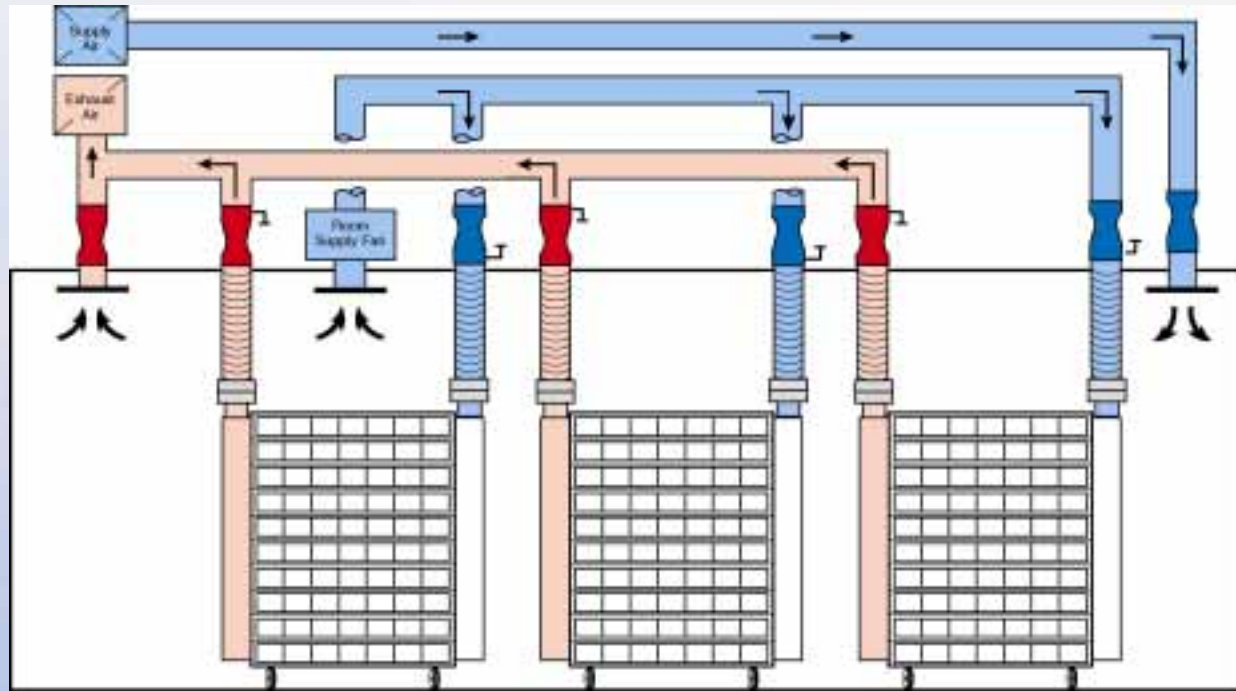
Automatic, Self-balancing Valve



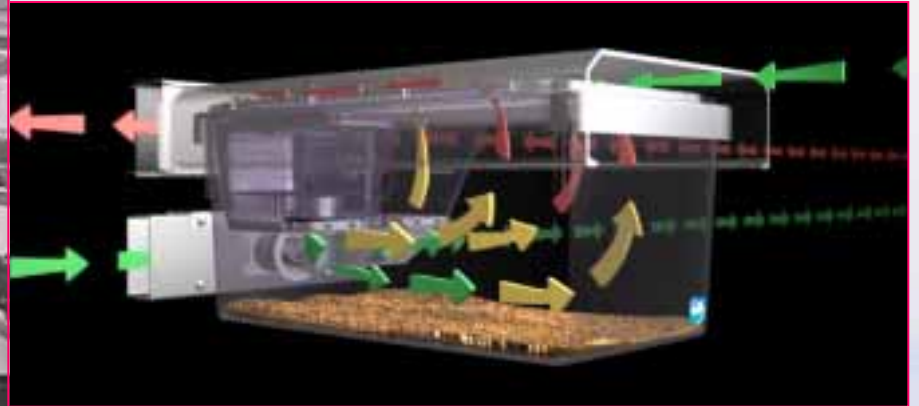
Self-balancing Valves on Exhaust Side of Cage Racks



Building Exhaust and Room Supply Unit



Conclusions



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Questions?

